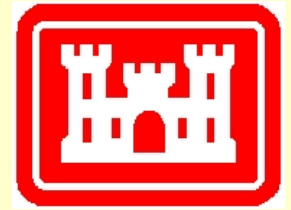


Cascade

Regional Model for Calculating Coastal Morphology Change and Sand Bypassing



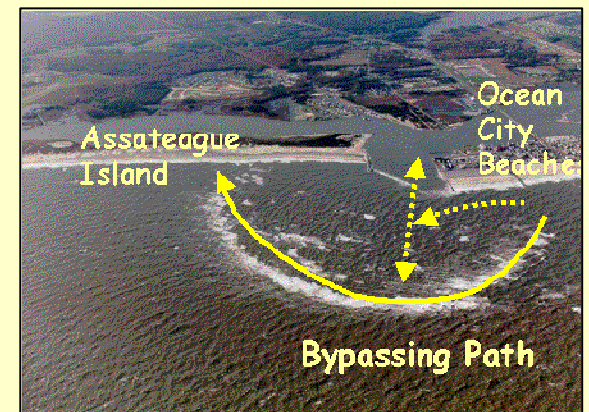
*Presented at 12th LICA Conference,
Stony Brook, April 5, 2007*



Regional Applications



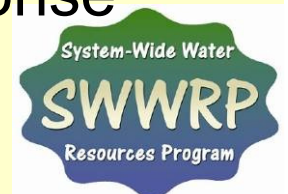
Engineering Activities



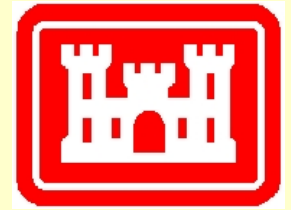
Long-term
Morphology
Response



*Julie Dean Rosati
Nicholas C. Kraus
Kenneth J. Connell
Magnus Larson*

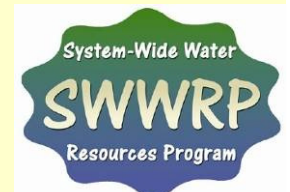


What is Cascade?

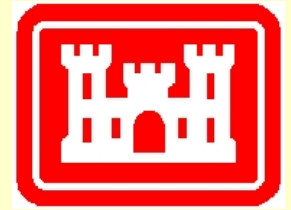


Regional longshore transport and beach change model that incorporates:

- Regional trends
- Multiple, interacting projects
- Inlet sediment storage and transfer
- Sources and sinks (beach nourishment, washover, breaching, wind-blown sand, cliff erosion, etc.)
- Jetty construction (impoundment, bypassing)
- Navigation channel maintenance
- Large-scale gradients in forcing; long-term trends (e.g., relative sea level rise, increased storminess)



Why is the model called “Cascade”?

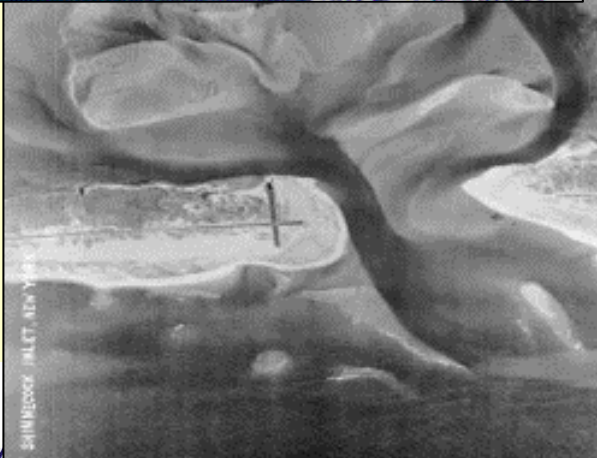
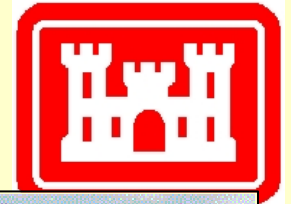


- Sediment transport & coastal evolution occur at many different scales:
 - *Near-term (months to years) and local;*
 - *Mid-term (years to decades) and project scale;*
 - *Long-term (decades to centuries) and regional-scale; cumulative project response.*
- Interaction between coastal evolution at different scales may be described through a cascading approach

Cascade --Able to leap across multiple inlets, channels, river mouths, beaches, barrier islands, etc., in a single (& fast) bound

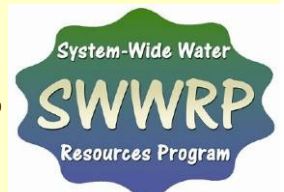


Morphological features that can be described in Cascade

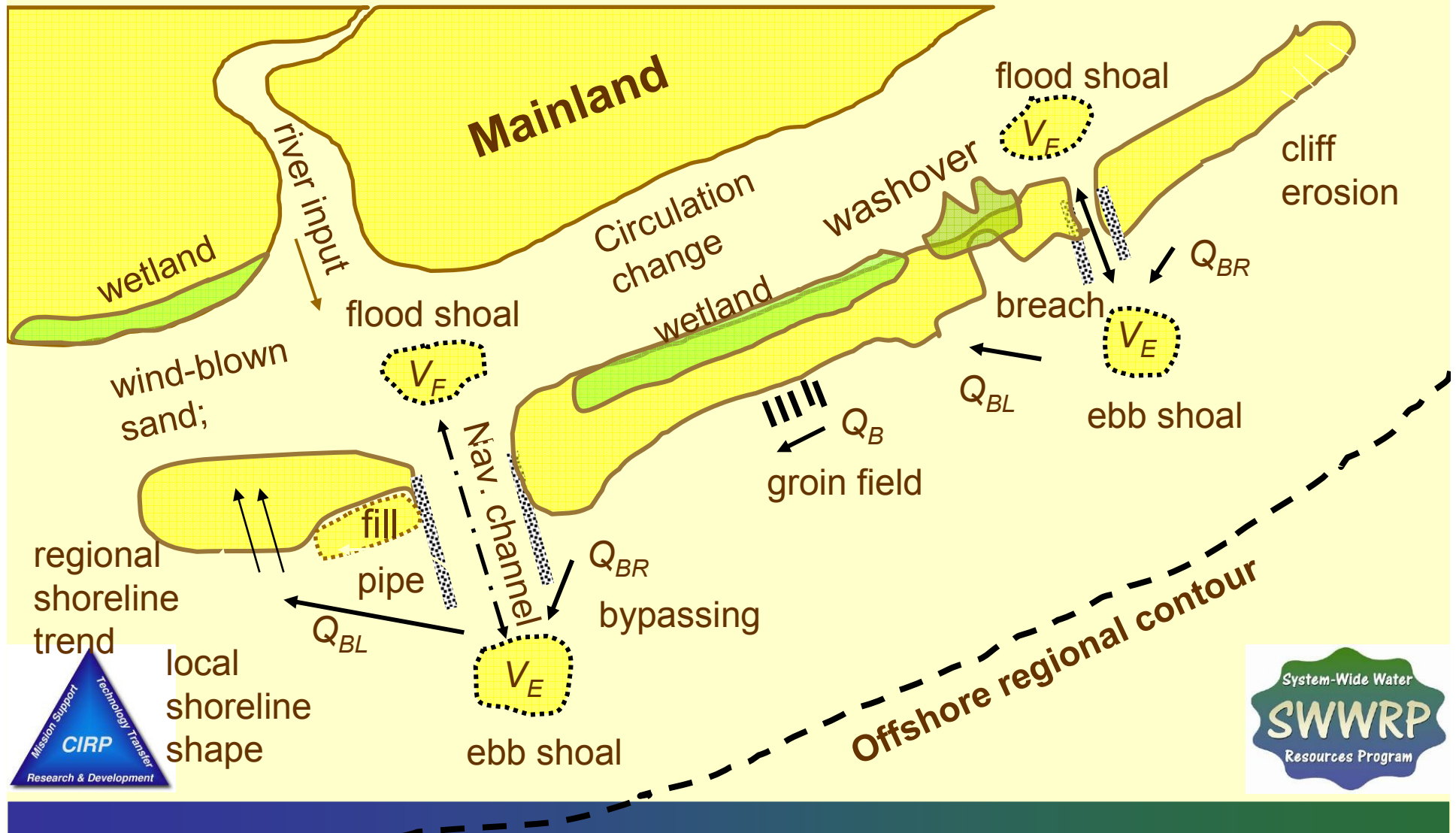
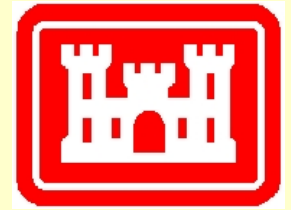


Time scales

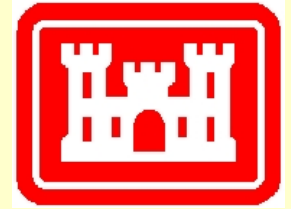
Space scales



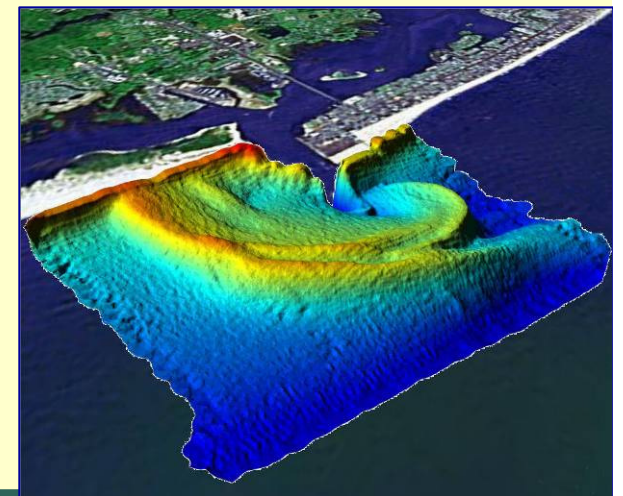
Components of Cascade



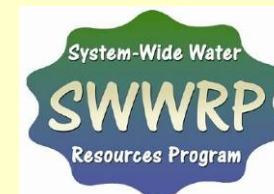
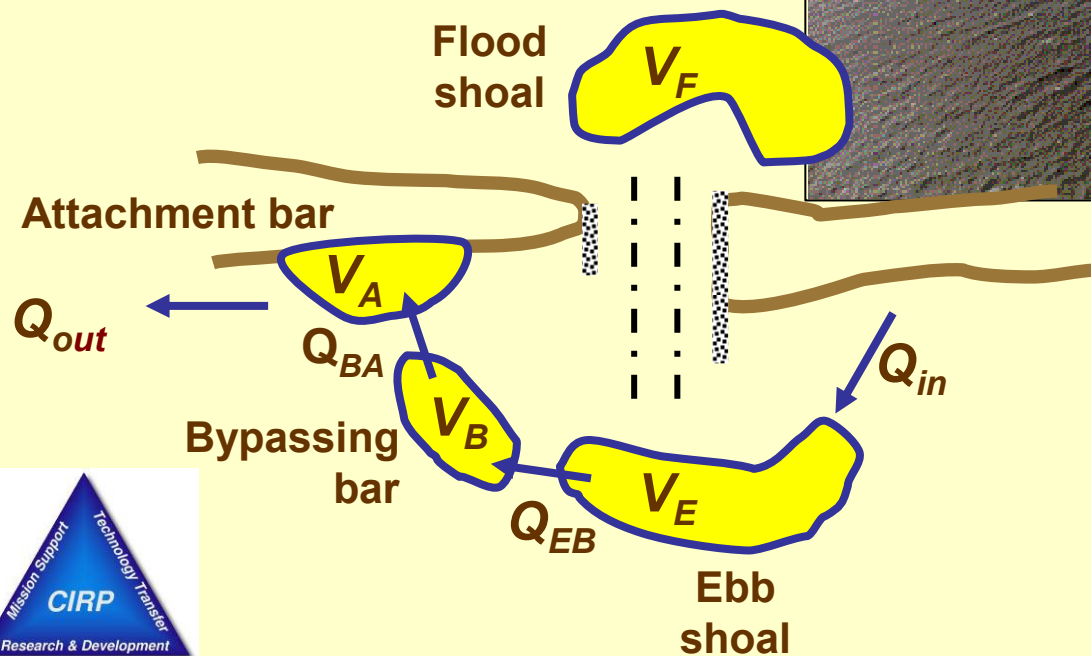
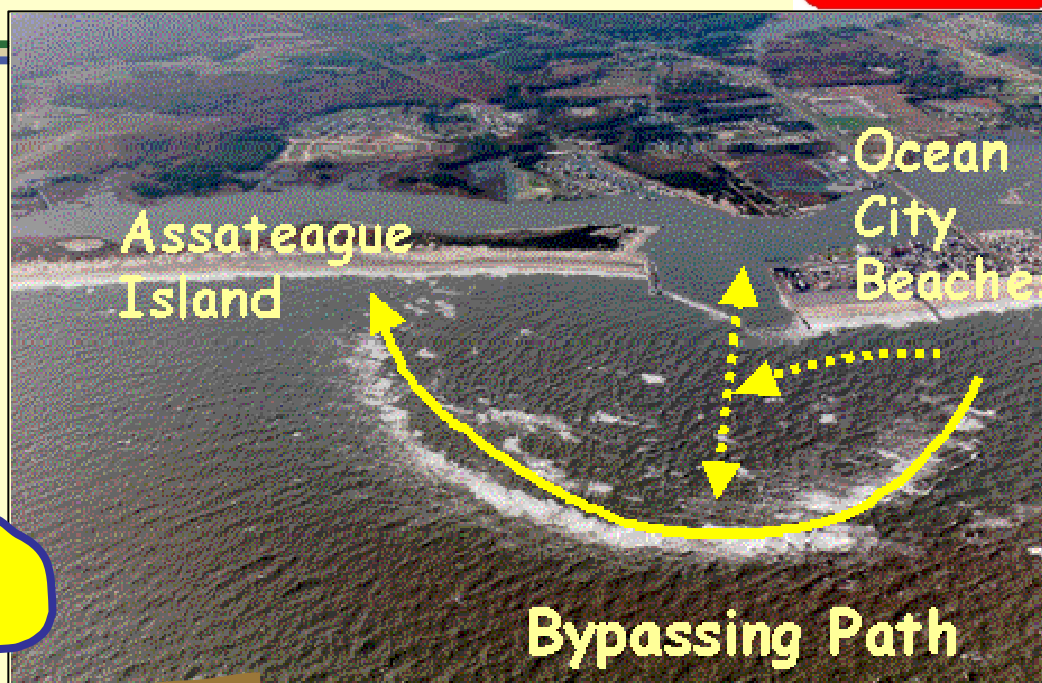
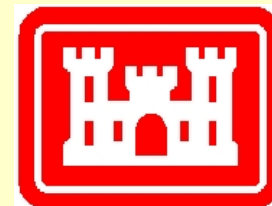
Modules in Cascade



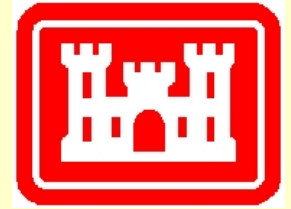
- Wave transformation
- Longshore current & sediment transport
- Inlet sediment storage & pathways
- Jetty bypassing
- Sediment sources and sinks
 - nourishment, dredged material placement
- Sediment volume conservation



Simulation of Shoal and Bar Volumes



What are the differences between Cascade and GENESIS?



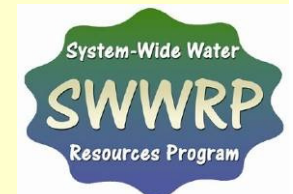
Cascade

- Planning-level tool
- Time scales: 1 to ~100 yrs
- Can model multiple inlets and barrier islands; cumulative impacts
- **Fast**

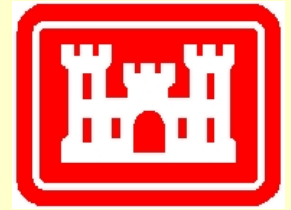
GENESIS

- Engineering Design Tool
- Time scales: 2-50 yrs
- Cannot transverse inlets

Cascade can provide boundary conditions for project-scale GENESIS modeling



Test Sites for Cascade Development and Validation

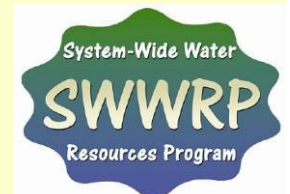


Completed Research Applications

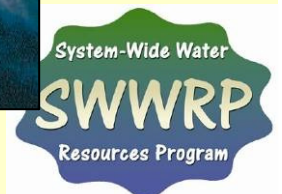
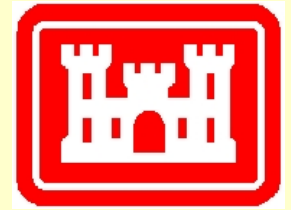
- South Shore of Long Island (Montauk Point to Fire Island Inlet), NY
- Ocean City Inlet with Fenwick and Assateague Island (Cape Henlopen to Chincoteague), Delmarva Peninsula

Future applications

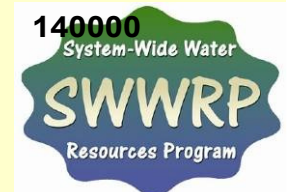
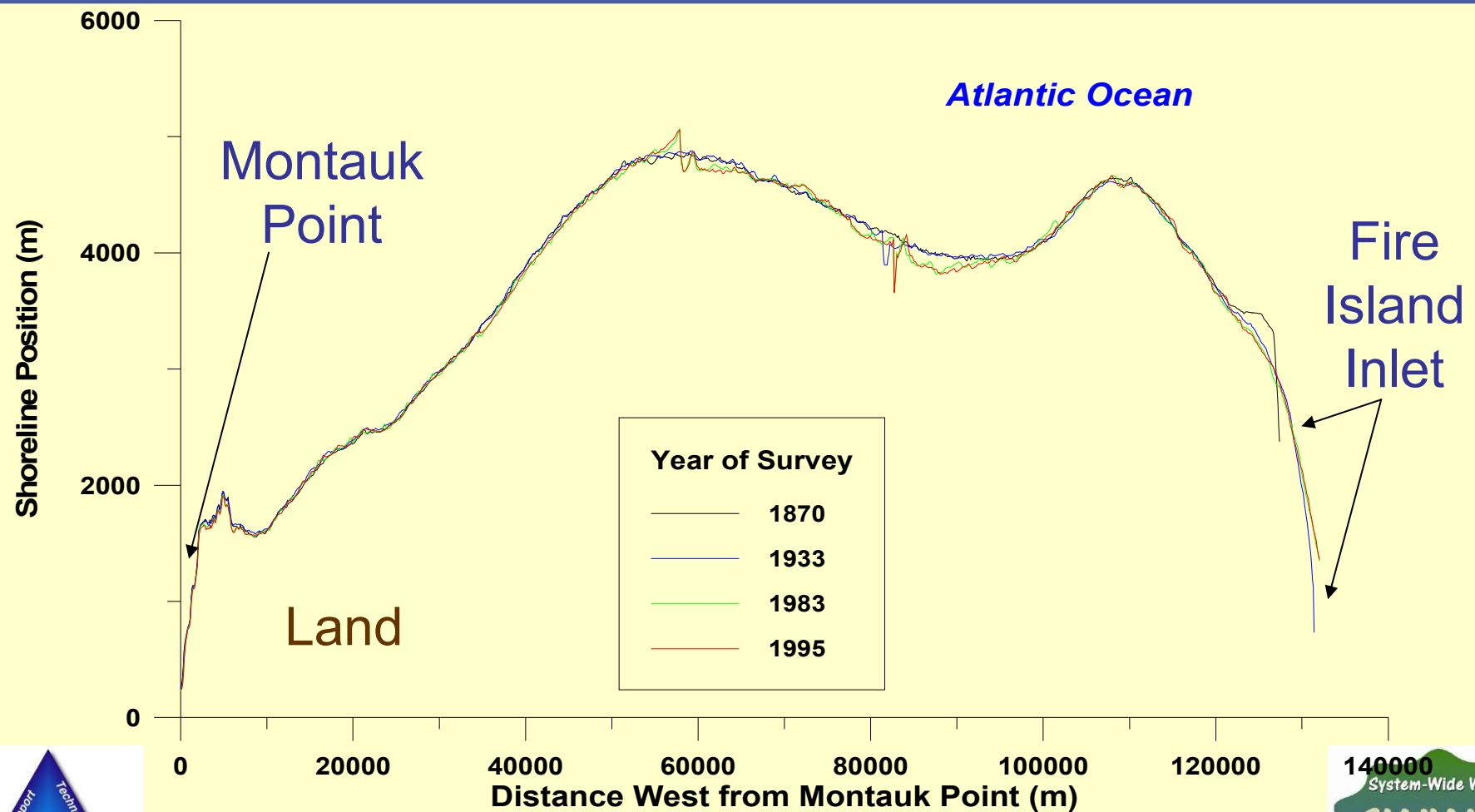
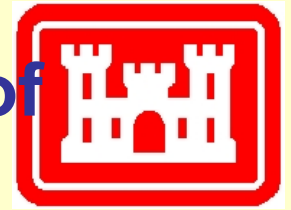
- Texas coast
- Other? – searching for partners



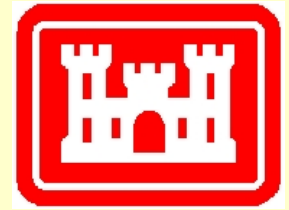
Long Island, NY



Shoreline Evolution, South Shore of Long Island (125 years)



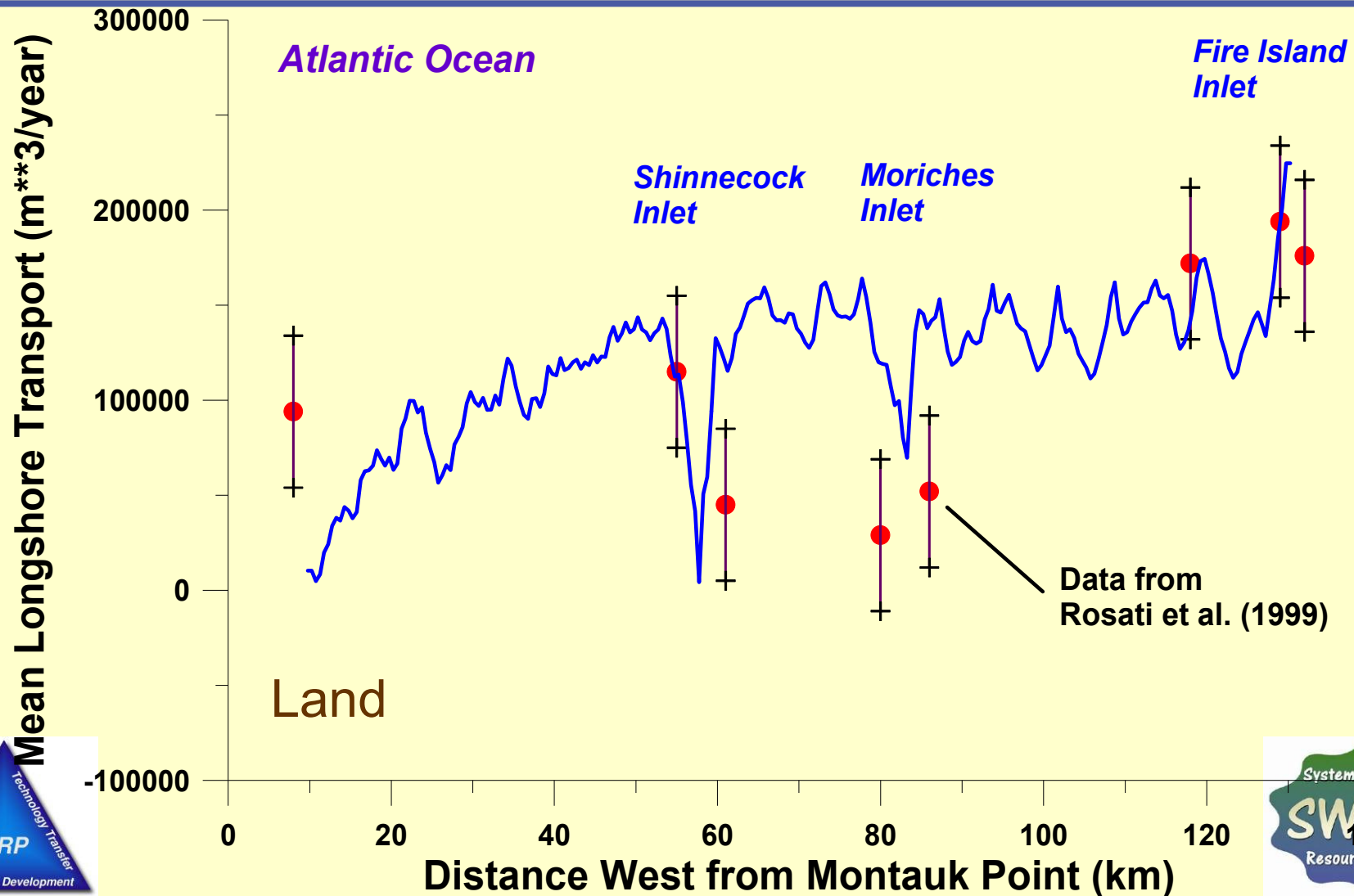
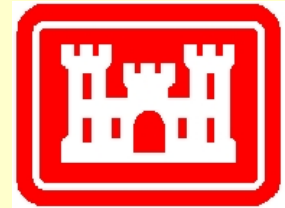
WIS Stations Along Long Island (old WIS)



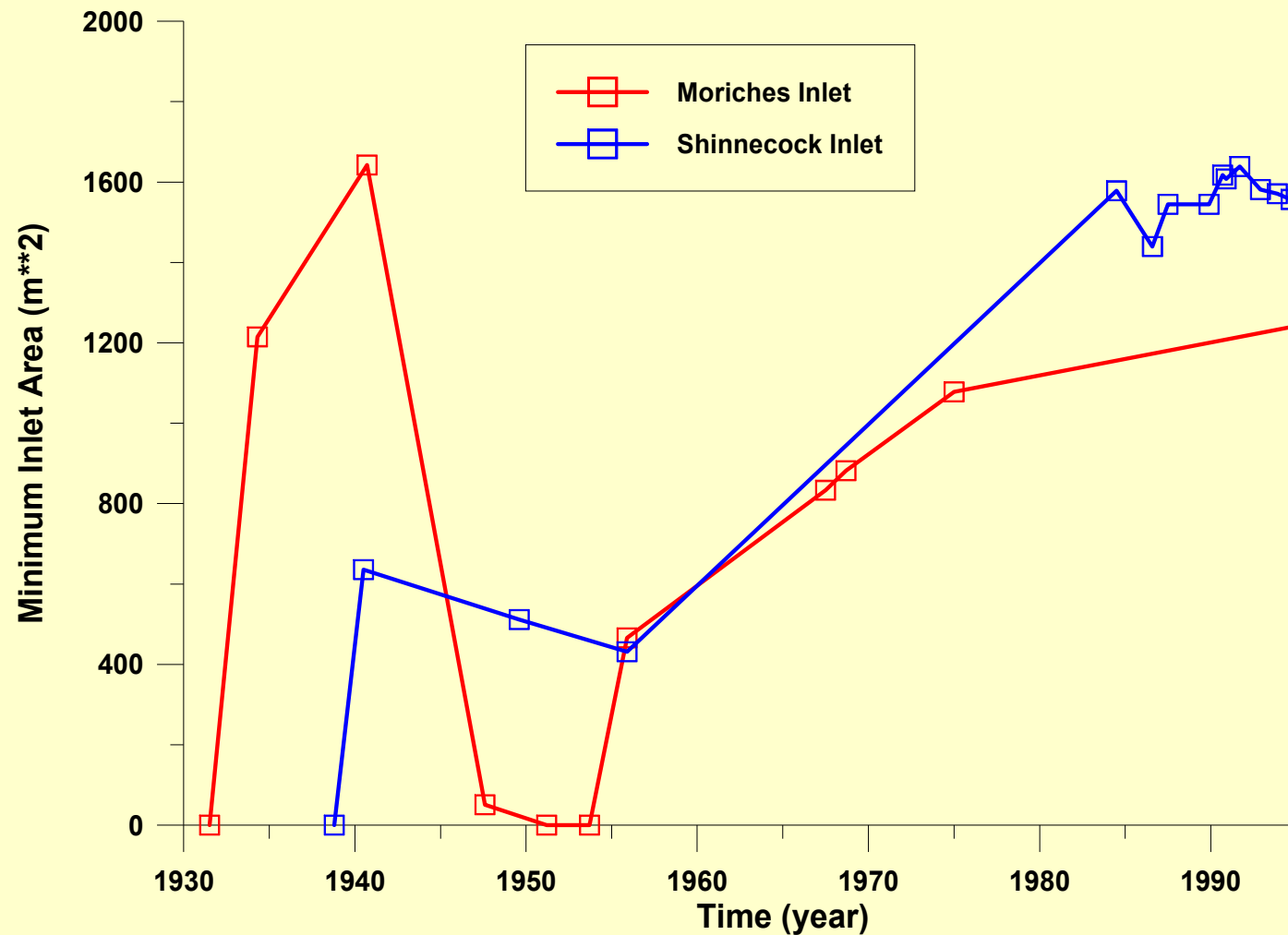
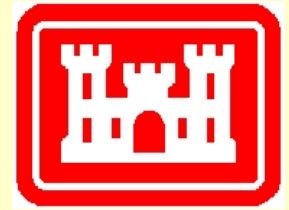
WIS stations along Long Island



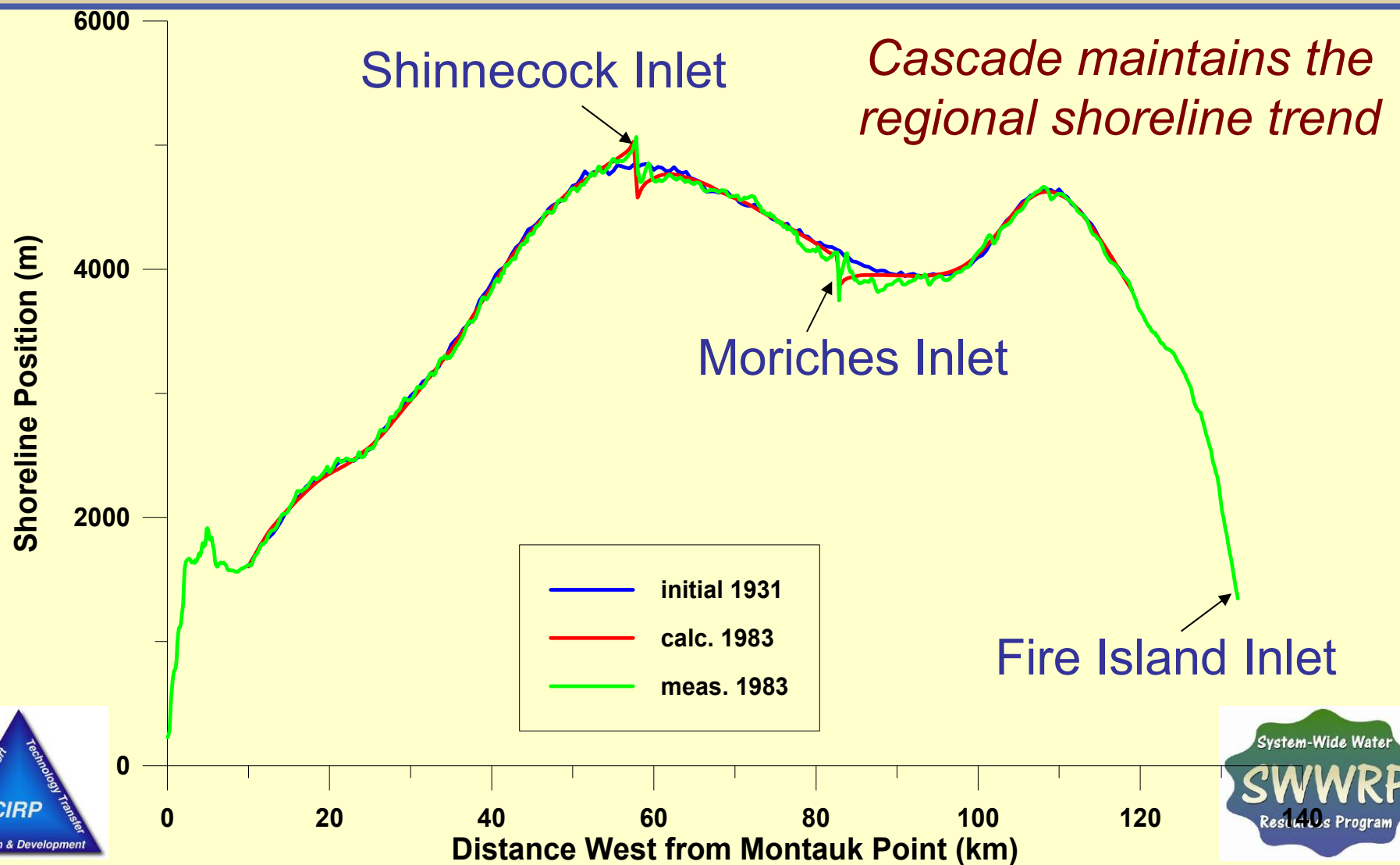
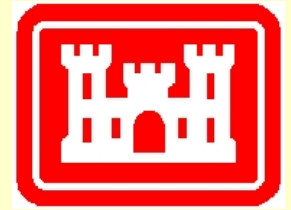
Calculated Net Longshore Sediment Transport Along the South Shore of Long Island



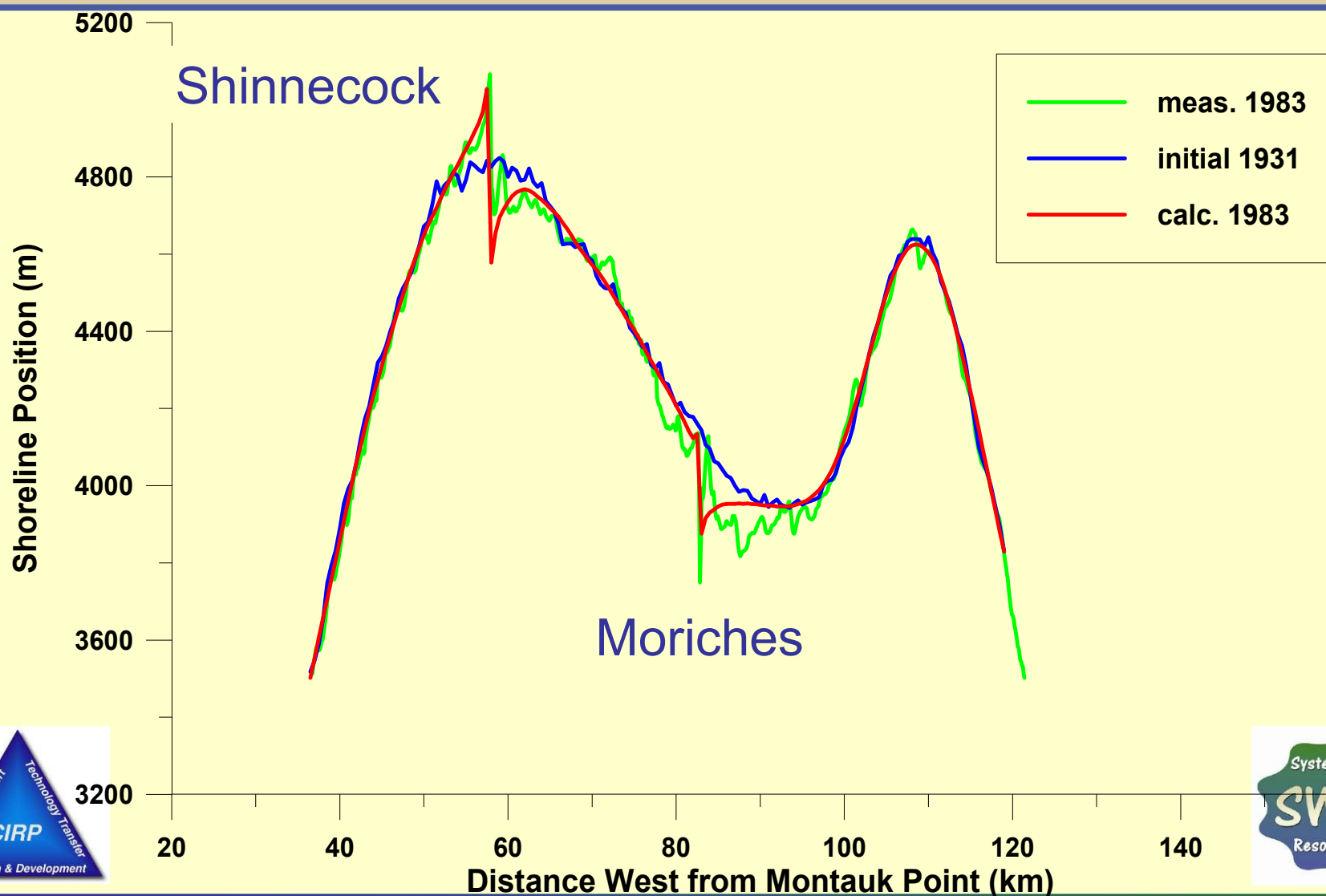
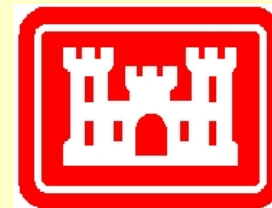
Recorded Changes in Inlet Cross-Sectional Area at Shinnecock Inlet and Moriches Inlet



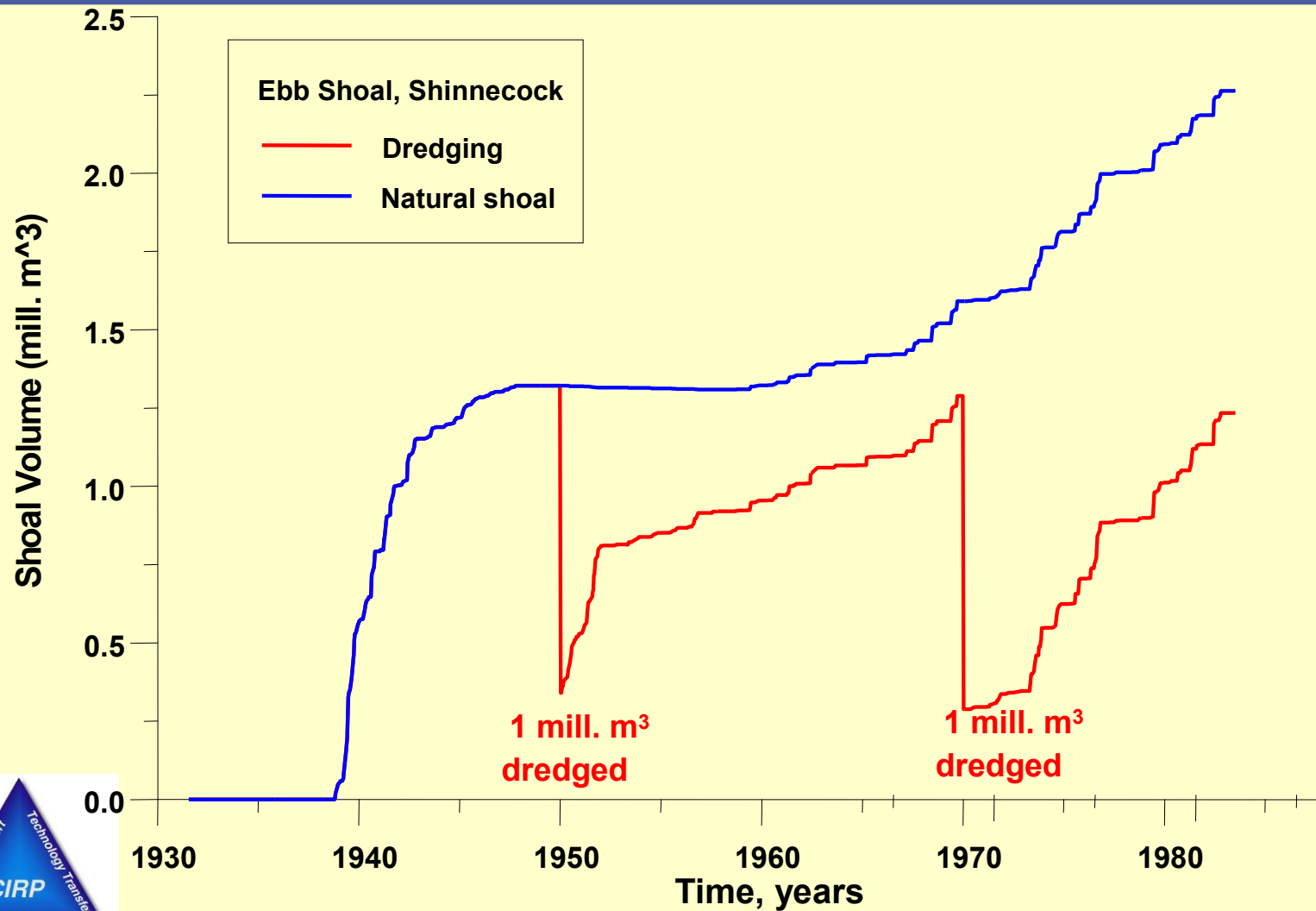
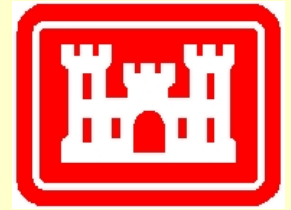
Simulation of Shoreline Evolution Long Island, 1931-1983



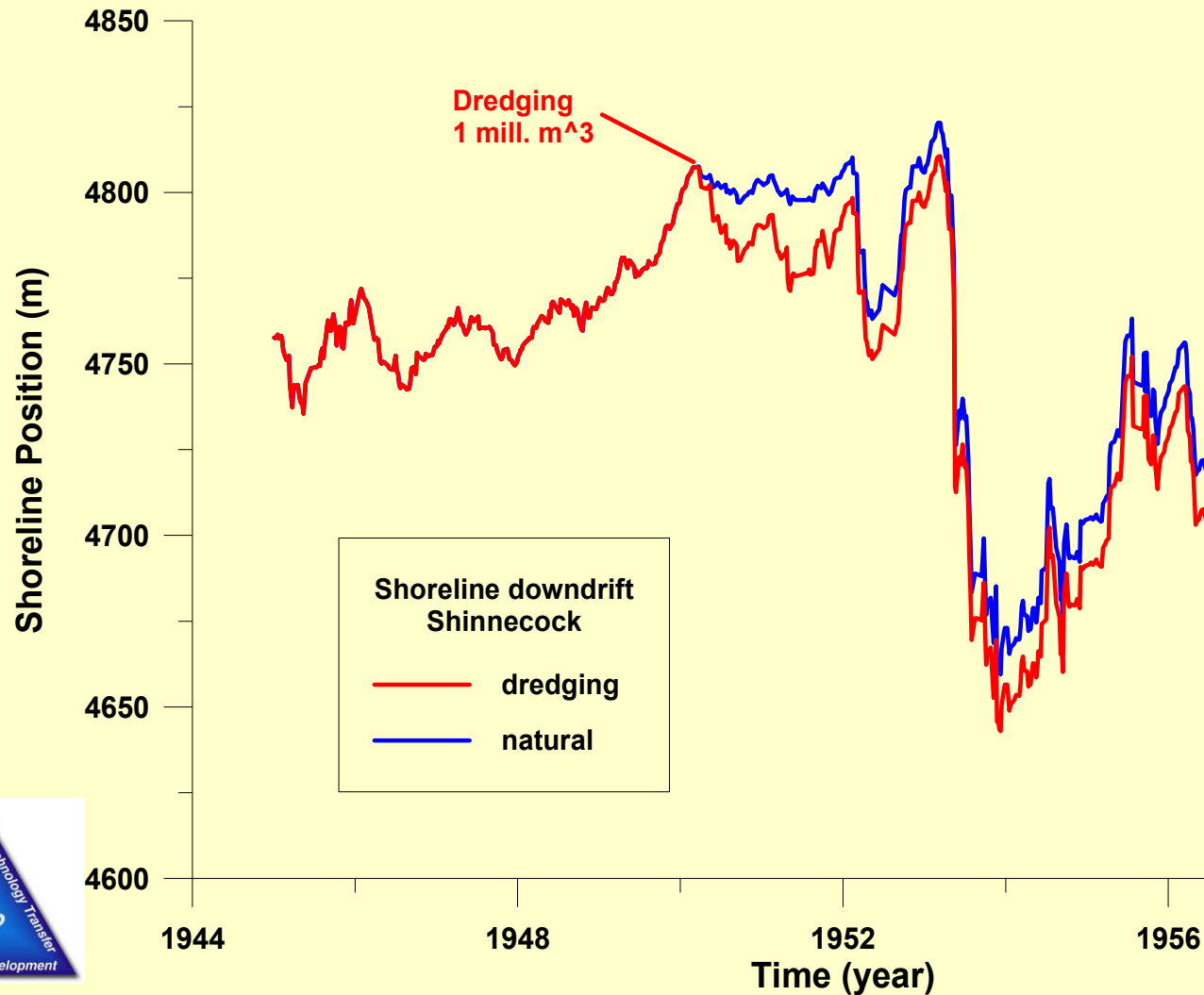
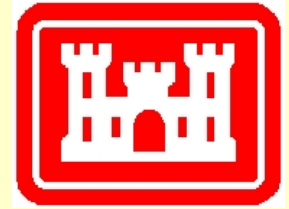
Simulation of Shoreline Evolution at Long Island, 1931-1983 (detail)



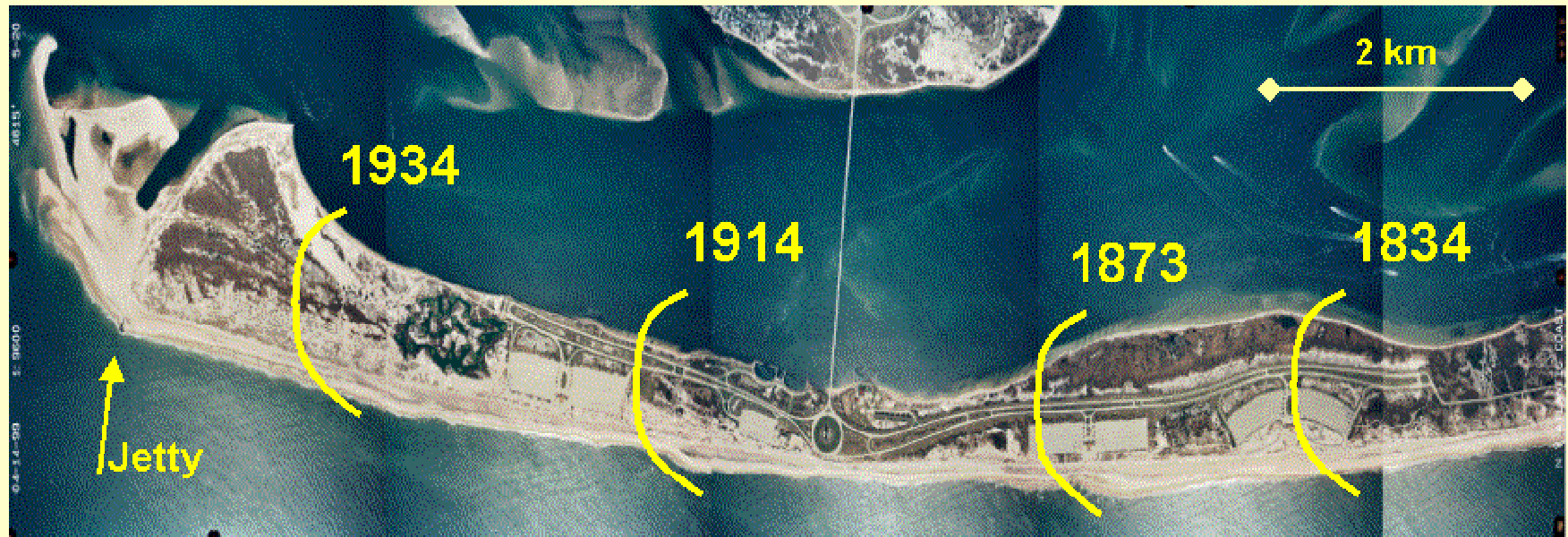
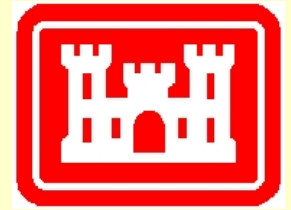
Simulation of Ebb Shoal Dredging, Shinnecock Inlet



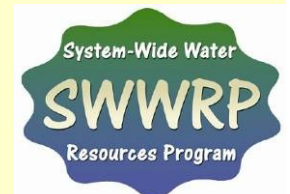
Response of Downdrift Shoreline Position in Response to Dredging, Shinnecock Inlet



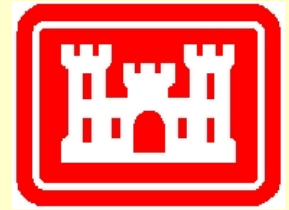
Upcoming effort: Spit BC in Cascade



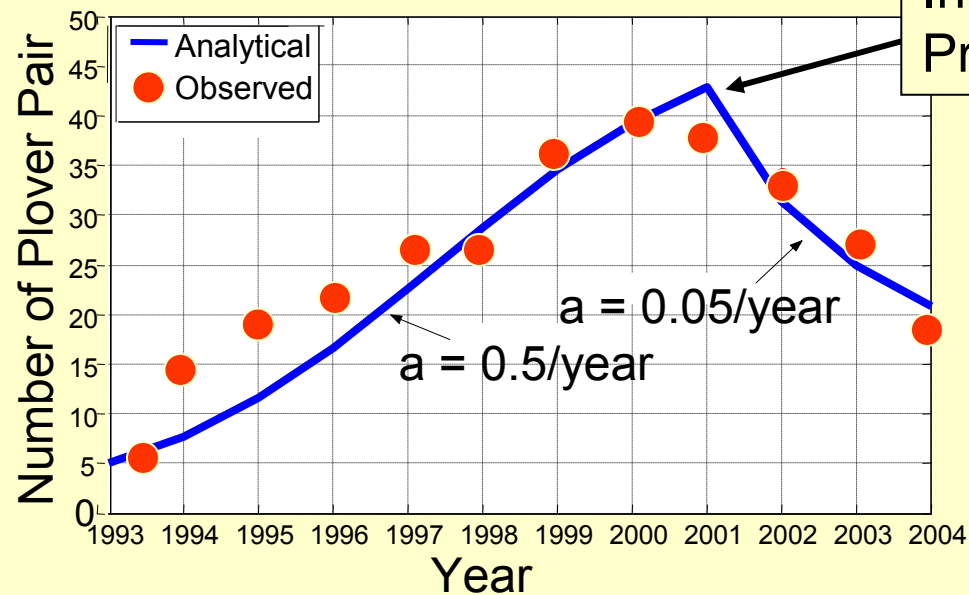
Fire Island Inlet, Long Island
-- is the terminus of a long barrier chain



Cascade Ecological Sub-Module *in Development*



Piping Plover Habitat & Population Dynamics



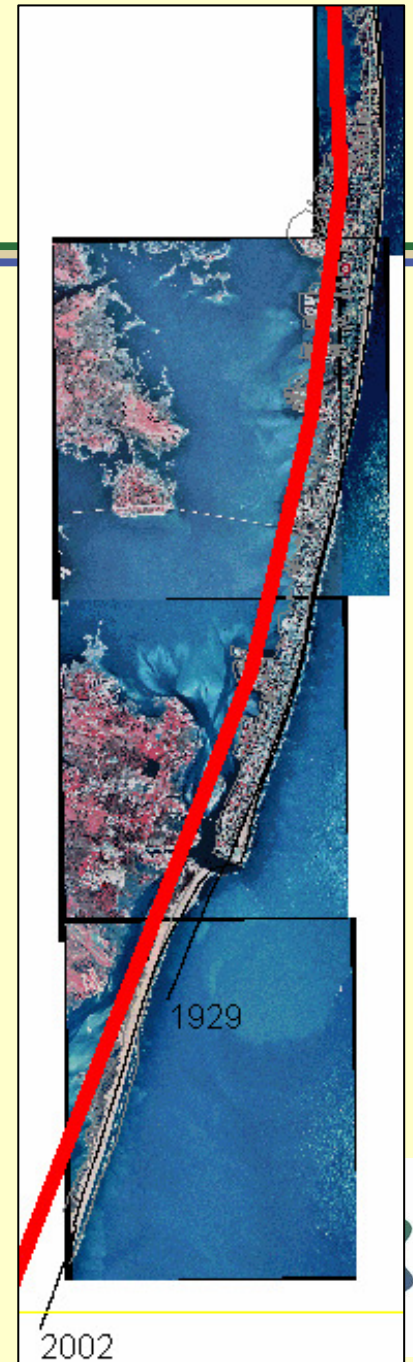
Increased
Predation?



Westhampton Dunes, NY

Cascade: Conclusions

- Sediment transport & coastal evolution occur at many different scales with implications for modeling – need Cascading approach
- Engineering projects require considerations at regional scale, → dictating need for modeling processes & controls at this scale
- Cascade can simulate coastal evolution within complex regional trends, including inlet sediment storage & transfer, engineering activities, & structures



Cascade: Future Development

- **Inlet module modifications**
 - modify downdrift sediment release (attachment bar)
- **Spit evolution**
- **Barrier island migration (washover)**
- **Transport relationships**
 - regional sediment transport
 - wind-blown sand transport
 - cliff erosion
- **Sediment exchange with offshore**
- **Long-term forcing**
 - relative sea level change
 - consolidation of substrate

